Space Weather Technical Forecast

Issued on Sunday, 01 September 2024 at 01:17 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: M-flares expected, slight chance of X-flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Moderate with four M-flares in the past 24hrs, peaking with an M1.8 at 31/1302UTC from AR3806 in the southeast. There are thirteen sunspot regions on the visible disc. The largest region remains AR3806 in the southeast, which has seen the ongoing emergence of small peripheral spots along with increasing penumbral extent. AR3807 near south centre disc continues to mature into a simple bipolar structure after its recent rapid growth. The regions emerging over the limb are still not yet fully visible, so the analysis will change, but one of them may be ex-AR3780 which was large and complex on the previous rotation. All other regions are relatively simple and stable at the present time.

No Earth directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar winds, as measured by ACE at L1, showed enhancement from CME and/or weak fast wind influence. Wind speeds were generally at slow-ambient levels, briefly becoming slightly elevated, varying between 340-410km/s, with density near or below average. The Interplanetary Magnetic Field, Bt, was weak to moderate throughout, varying erratically at times, ranging through the period between 3-13nT. The north-south component, Bz, was moderately negative for much of the period, switching to become weakly positive between 31/0550-1300UTC, and then again between 31/1450-1715UTC. Bz ranged between +8 and -11nT. Phi angle was mostly positive (away from the Sun), switching briefly to negative (towards the Sun) for a couple of hours from 31/1345UTC. Geomagnetic activity was Quiet to Active (Kp2-4).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background levels. The 24-hour fluence was below the Active threshold, with 2.52e6 integrated pfu observed at 01/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is expected with a slight chance of isolated X-flares. The main flare risk is currently from AR3806 in the southeast.

Solar Wind /Geomagnetic Activity: There are no Earth-directed CMEs currently expected. The ongoing enhancement is due from either a weak high speed stream and/or weak transient. Further minor geomagnetic activity is possible on Day 1 (01 Sep), with the next forecast enhancement expected either late on Day 1, or more likely on Day 2 (02 Sep), from a narrow negative polarity equatorial coronal hole. A significant enhancement is unlikely, however.

Mainly Quiet to Active (Kp2-4) activity is expected at first, with a slight chance of G1/Minor Storm intervals (Kp5) on Day 1 (01 Sep) under weak fast wind or transient influence, then again on Day 2 (02 Sep) with further fast wind enhancement possible. The risk then decreasing from Day 3 (03 Sep) onwards, with generally Quiet (Kp1-2) activity expected.

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Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background levels, with only a very slight chance of reaching the S1/Minor Radiation Storm level. High energy electron flux is expected to remain at background levels, perhaps reaching moderate at times during diurnal maximum. The associated 24-hour fluence is expected to persist below Active.

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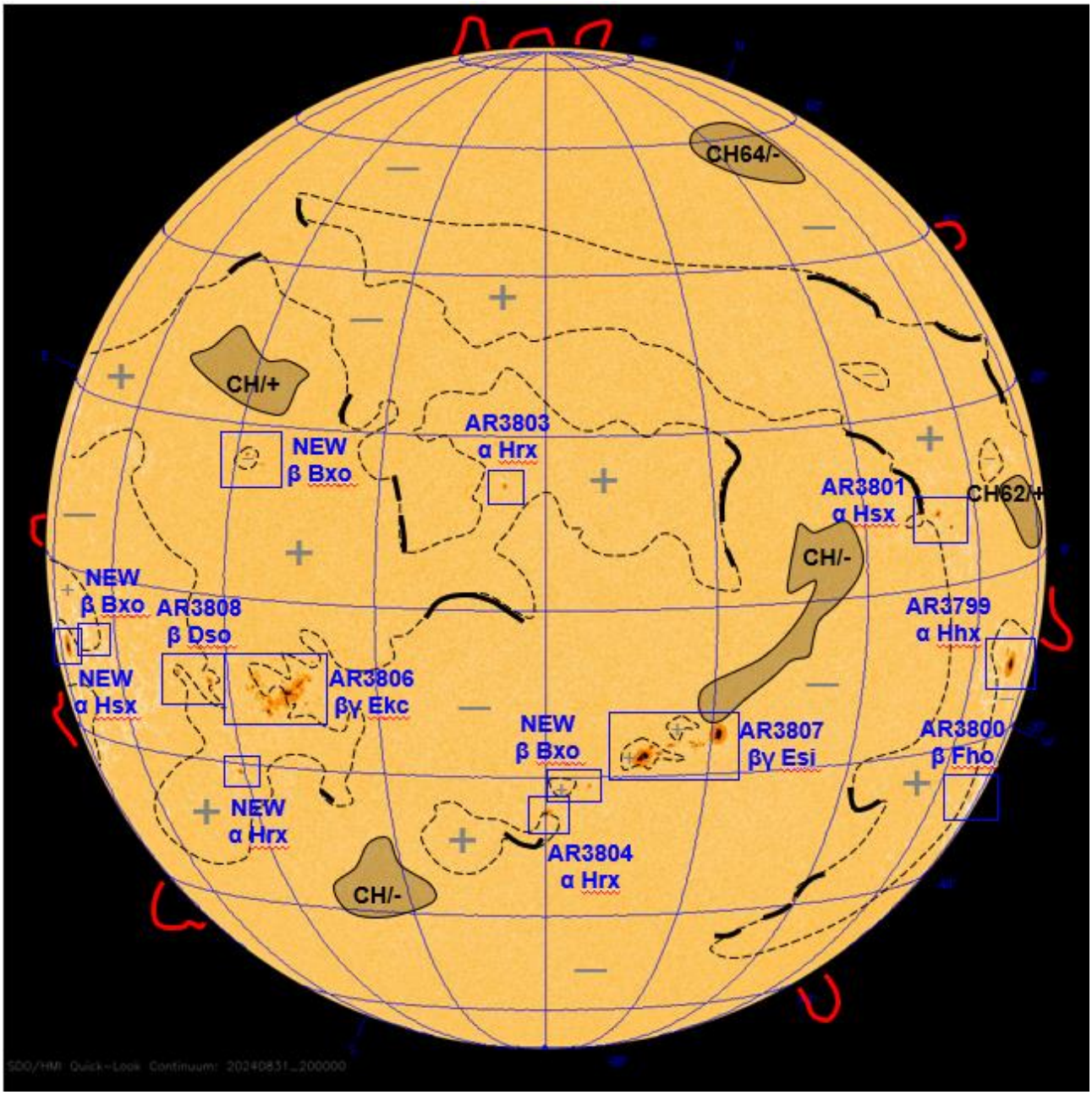
Figure 1. Solar Analysis Valid 31/2000UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs currently expected. A filament eruption around 30/2330 UTC is expected to miss behind Earth's orbit, but the analysis is low confidence due to poor available imagery, and so a glancing blow cannot be ruled out, perhaps on Day 3 (03 Sep).

The ongoing enhancement is likely due to a weak fast wind and/or a weak transient. Solar winds are at background to slightly elevated speeds currently, with extended periods of southward deflected magnetic field. Should the magnetic field remain southward, further minor geomagnetic activity is possible through early Day 1 (01 Sep).

The next forecast enhancement is expected either late on Day 1 or perhaps more likely on Day 2 (01-02 Sep) from the narrow negative polarity coronal hole straddling the equator in the western hemisphere. Any notable enhancement is low confidence, due to its small size, lack of persistence and unfavoured polarity for the time of year. MOSWOC Enlil is also thought to be overestimating the enhancement on Day 2, suggesting a strong and broad coronal hole fast wind connection that is not expected.

Mainly Quiet to Active (Kp2-4) activity is expected at first, with a slight chance of G1/Minor Storm intervals (Kp5) on Day 1 (01 Sep) under ongoing weak fast wind or transient influence, then again on Day 2 (02 Sep) with further fast wind enhancement possible. The risk then decreasing from Day 3 (03 Sep) onwards in the absence of any CME glance, with generally Quiet (Kp1-2) activity expected.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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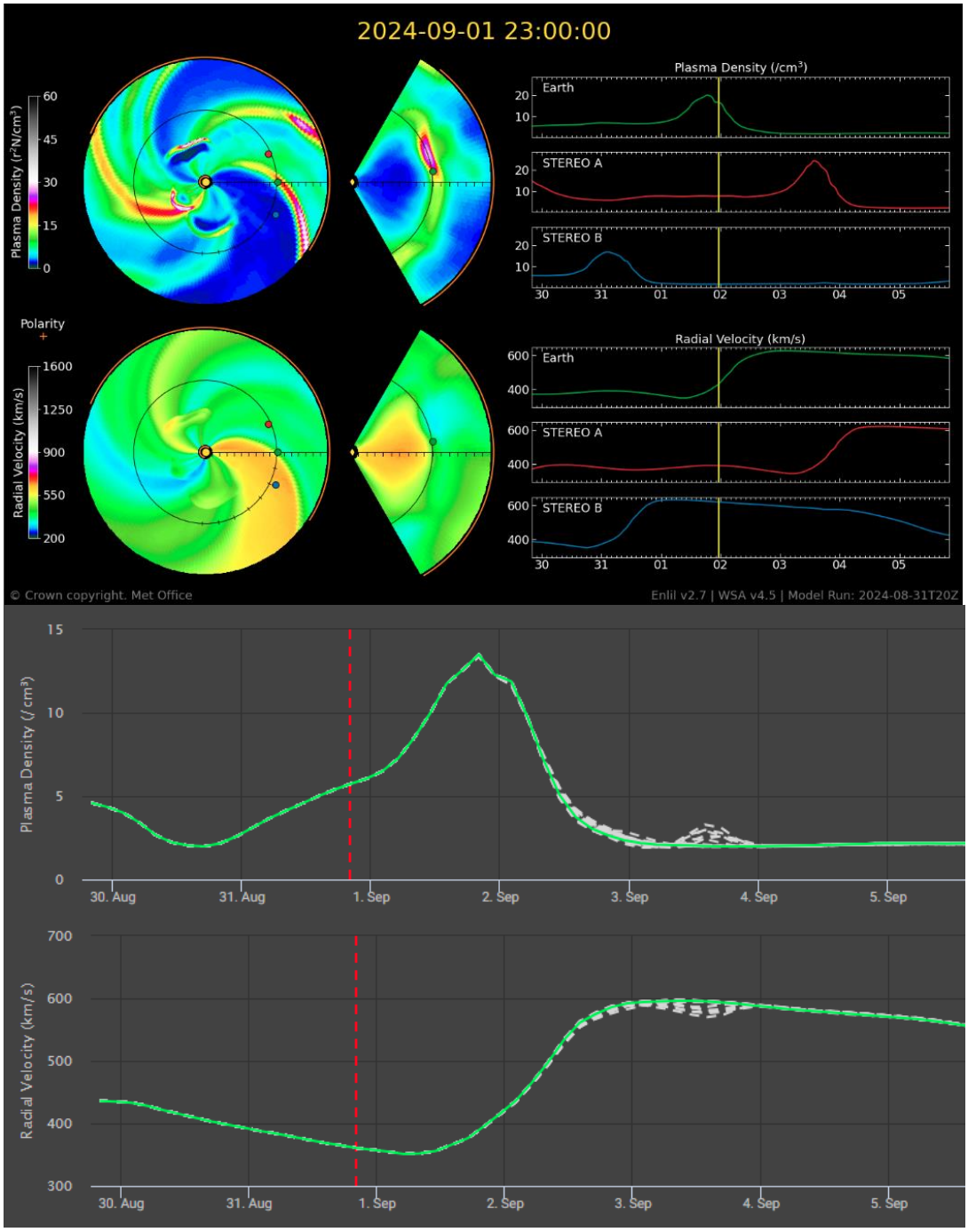
Figure 2: MOSWOC Enlil and Ensemble models. Both are likely overplaying the strength and longevity of fast wind influence from late Day 1 onwards.



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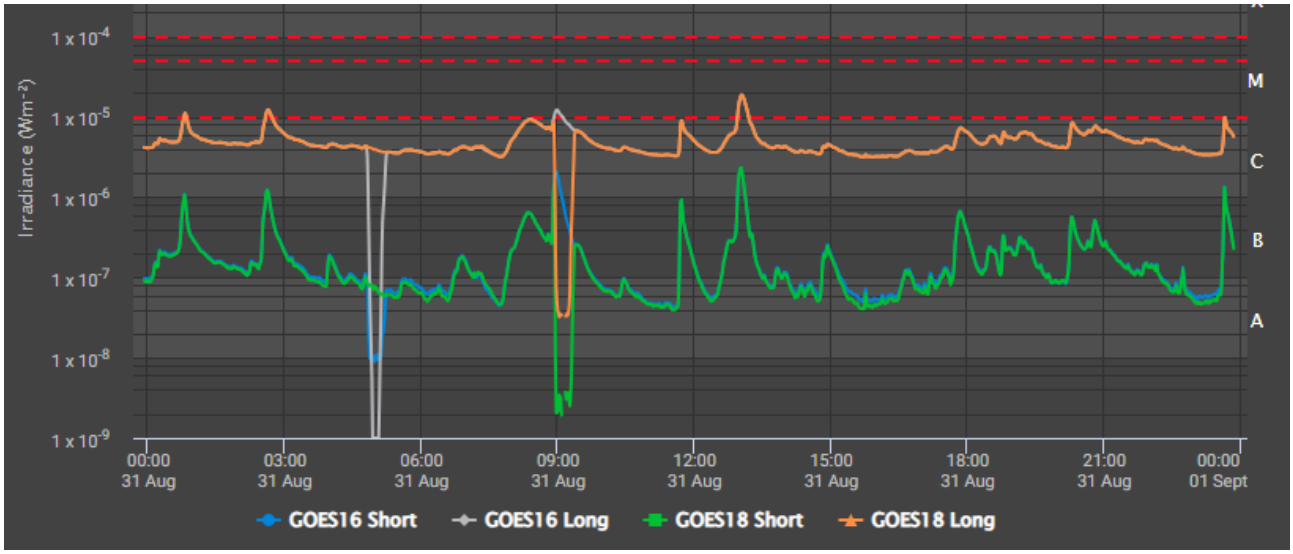
Radio Blackouts - X-Ray Flares:

There are now thirteen sunspot regions on the disc, with two new regions appearing on the east limb. The largest region is AR3806 in the southeast, which has seen the ongoing emergence of small peripheral spots, perhaps partly due to more detail becoming apparent as the region moves towards a clearer viewing angle, but also due to rearrangement of the larger spots. This is a reasonably complex region, with potential for further growth and hints that a delta spot may develop. AR3807 near south centre disc has matured into a simple bipolar structure after its rapid growth yesterday, but is starting to show signs of developing mixed polarity spots in the intermediate portion. A number of its intermediate spots have also recently merged into the leader and trailer spots. The regions emerging over the limb are still not yet fully visible, so the analysis will change, but one of them may have the potential to be a strong region and may be ex-AR3780 which was large and complex on the previous rotation. All other regions are relatively simple and stable at the present time.

Further Moderate activity is expected, with a slight chance of rising to High. Although there are three regions rotating off the disc in the coming days, if the new region on the east limb is ex-AR3780 then this may well balance any losses - or even raise the probabilities a little. However, we need to wait for a clearer view before this can be properly assessed, and as such a flat flare risk is maintained.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	75	75	75	75
Very Active	R3 to R5 X Class	No	15	15	15	15

Figure 3: GOES-16 & -18 X-ray flux showing four M-class flares over the past 24hrs.



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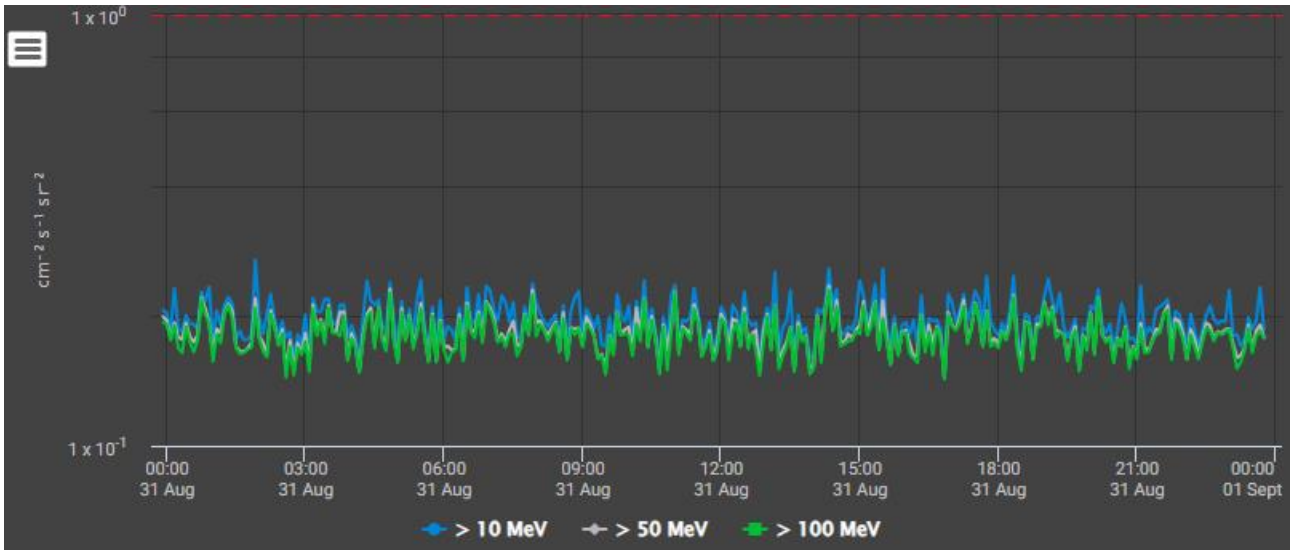
Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is likely to persist at background levels with a slight chance of rising in response to any notable flares. While there are a few sunspot regions on the western disc, which is the better connected region of the Sun to give the potential for proton flux rises at GEO, these are generally fairly simple magnetically. The risk rises a little beyond Day 3 (03 Sep) as AR3806 crosses into the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: GOES-18 Proton flux showing background conditions.



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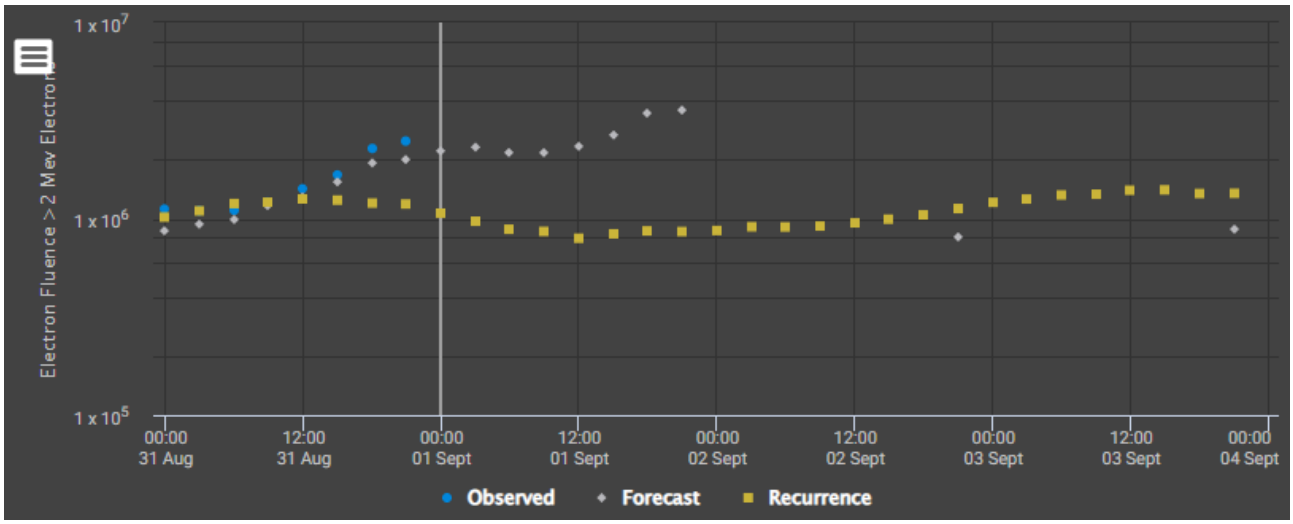
High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 is currently at background levels. Recent enhancements have given some geomagnetic activity but little in the way of wind speed increases. Whilst there is the potential for increased electron counts at lower orbits, this is considered unlikely to be significant. Periods of moderate flux are possible during diurnal maxima over the coming days.

Despite the potential for any increased flux, the associated 24 hour Fluence is expected to remain below the Active (1e8 integrated pfu) threshold throughout, although a slight rising trend is likely. MOSWOC REFM is providing good guidance for staying below this level, but likely underestimating any potential rising trend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM.



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